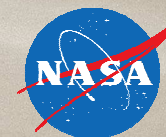


National Aeronautics and Space Administration



NASA Aeronautics Research *Then and Now*

Dr. Jaiwon Shin
Associate Administrator
NASA Aeronautics Research Mission Directorate



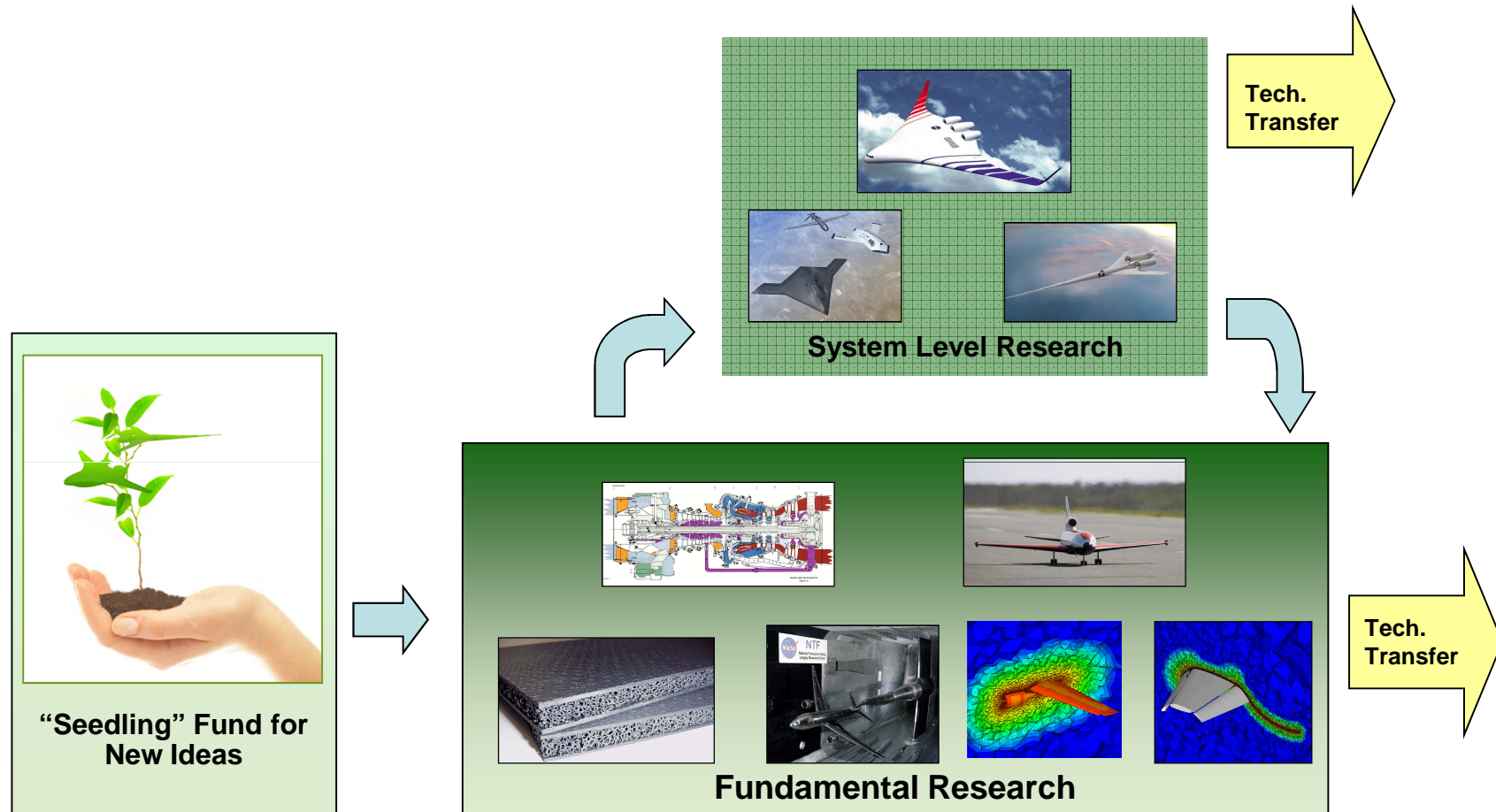
48th AIAA
Aerospace Sciences Meeting
January 4, 2010
www.nasa.gov

Major Aeronautics Challenges & Opportunities



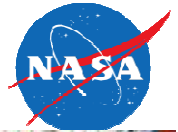
- **Environmental Compatibility**
 - Emissions - CO₂ and NO_x
 - **Aviation creates 2% of worldwide emissions**
 - Noise
 - **Airport community noise reduction**
 - > Increased access to 5,221 US public use airports
 - > FAA attempt to reconfigure New York airspace resulted in 14 lawsuits
 - > Since 1980 the FAA has invested over \$5 billion in airport noise reduction programs
 - > Noise insulation of 6000 Chicago homes cost over \$18M and \$285M allocated for schools
 - **Sonic Boom over land**
 - > Enhance Supersonic Transport economic viability
- **Economic Efficiencies**
 - Airspace System Capacity
 - **\$5.9B economic impact of airline delays in 2005**
 - Fuel Consumption
 - **Exceeded 26% of airline operating cost in 2006**

NASA Aeronautics Investment Strategy



Enabling “Game Changing” concepts and technologies from advancing fundamental research ultimately to understand the feasibility of advanced systems

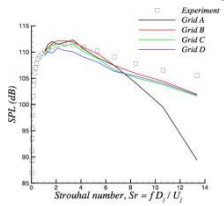
Chevrons - The Road From Idea to Deployment



Initial service entry, 2002

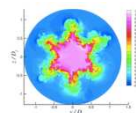
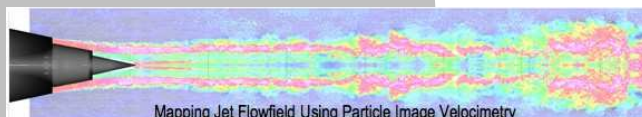
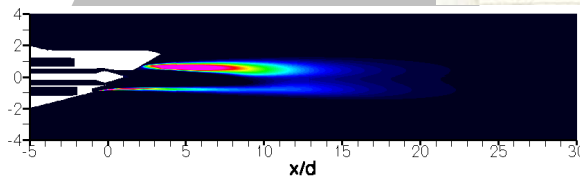
Systems Assessment: 2001-2005

- Ground-test evaluation in engine test stands
- Flight evaluation in relevant environments



Fundamental Research: 1996-2000

- Computational and experimental research to develop a fundamental understanding of the fluid mechanics governing the effectiveness of the concept
- Development of practical implementations (chevrons)



Seedling Idea: 1994-1996

Basic studies on jet mixing suggest that tabs can enhance jet mixing, with the potential to reduce noise

Technology Impacts Flight Operations



- NASA has **open-sourced** many of its key data mining algorithms for analysis of data from flight data recorders through **DASHlink**, our Web 2.0 portal for the world.
- **Southwest Airlines** sought sequenceMiner and Orca, two advanced anomaly detection techniques.
- Early results indicate that **operationally significant** events have been discovered by these algorithms that would not be triggered by their existing methods.

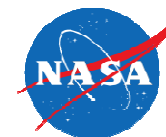


dashlink.arc.nasa.gov



- Southwest Airlines plans to incorporate algorithms into **daily operations**.
- 5 year **non-reimbursable** Space Act Agreement is being drafted.

NASA Aeronautics Portfolio in FY2010

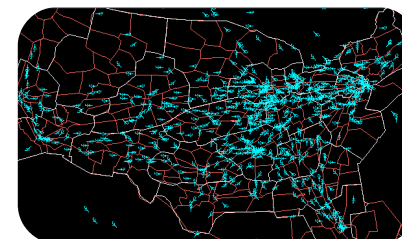


Fundamental Aeronautics Program

Conduct cutting-edge research that will produce innovative concepts, tools, and technologies to enable revolutionary changes for vehicles that fly in all speed regimes.

Integrated Systems Research Program

Conduct research at an integrated system-level on promising concepts and technologies and explore/assess/demonstrate the benefits in a relevant environment



Airspace Systems Program

Directly address the fundamental ATM research needs for NextGen by developing revolutionary concepts, capabilities, and technologies that will enable significant increases in the capacity, efficiency and flexibility of the NAS.



Aviation Safety Program

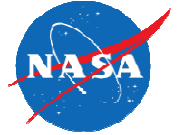
Conduct cutting-edge research that will produce innovative concepts, tools, and technologies to improve the intrinsic safety attributes of current and future aircraft.



Aeronautics Test Program

Preserve and promote the testing capabilities of one of the United States' largest, most versatile and comprehensive set of flight and ground-based research facilities.





ISRP Goal and Characteristics

Integrated Systems Research Program (ISRP):

Research and technology (R&T) program, that will conduct research at an integrated system-level on promising concepts and technologies and explore, assess, or demonstrate the benefits in a relevant environment

Criteria for selection of projects for Integrated Systems Research:

- Technology has attained enough maturity in the foundational research program that they merit more in-depth evaluation at an integrated system level in a relevant environment
- Technologies which systems analysis indicates have the most potential for contributing to the simultaneous attainment of goals
- Technologies identified through stakeholder input as having potential for simultaneous attainment of goals
- Research not being done by other government agencies and appropriate for NASA to conduct

Environmentally Responsible Aviation Project Goals

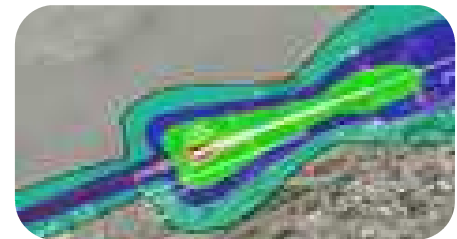


Environmentally Responsible Aviation (ERA)

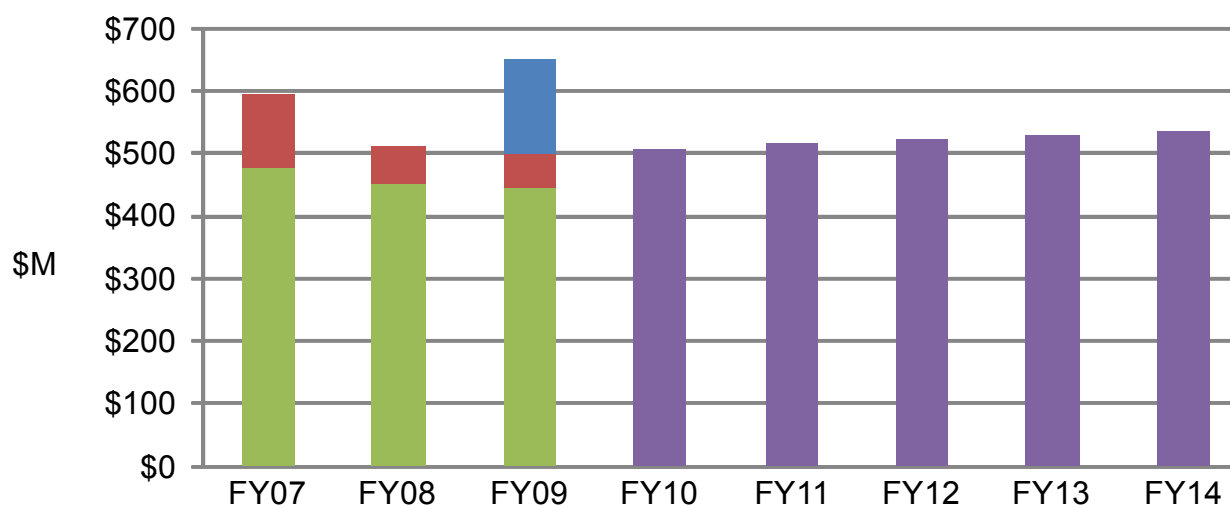
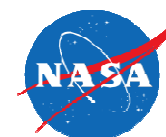
Project:

Technology development project, that will explore and assess new vehicle concepts and enabling technologies through system-level experimentation to *simultaneously* reduce fuel burn, noise, and emissions

- *Airframe Technology*
- *Propulsion Technology*
- *Vehicle Systems Integration*

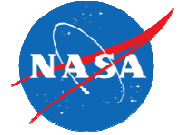


ARMD Budget for FY2007-FY2015



Recovery Act			\$150.0					
Congressional Augmentation	\$116.0	\$60.0	\$53.5					
Budget Requests	\$477.8	\$451.4	\$446.5					
FY10 President's Budget Submit				\$507.0	\$514.0	\$521.0	\$529.0	\$536.0
Total Budget	\$593.8	\$511.4	\$650.0	\$507.0	\$514.0	\$521.0	\$529.0	\$536.0
<i>Aviation Safety Program</i>	\$87.4	\$66.5	\$89.3	\$60.1	\$59.6	\$59.2	\$61.7	\$62.5
<i>Airspace Systems Program</i>	\$102.5	\$100.1	\$121.5	\$81.4	\$82.9	\$83.9	\$87.3	\$88.3
<i>Fundamental Aeronautics Program</i>	\$330.4	\$269.7	\$307.6	\$228.4	\$230.0	\$233.6	\$239.0	\$245.9
<i>Aeronautics Test Program</i>	\$73.5	\$75.1	\$131.6	\$74.7	\$77.1	\$77.2	\$76.6	\$78.8
<i>Integrated Systems Research Program</i>	\$0.0	\$0.0	\$0.0	\$62.4	\$64.4	\$67.1	\$64.4	\$60.5

Note: The budget request columns for FY07 and FY08 have been adjusted from the initial request to reflect full cost simplification. The FY09 budget request column is from the FY09 President's Budget.



Four Emphases

Conduct world class research

- Research at four research centers (LaRC, GRC, ARC, and DFRC), each with unique capabilities and facilities
 - 1377 civil servants and 680 contractors; \$308 M or 62% of the ARMD budget
- Integrated collaboration of research and management across research centers
- National recognition:
 - Back-to-back Collier trophies (ADS-B, CAST)

Transition research to the nation

- Supporting research needs and discovering advancements with industry and academia (over 80 Space Act Agreements with large and small manufacturers; 380 NASA Research Announcements awarded since 2006)
- Transitioning research results for real-world application (chevron nozzles, SFO stratus and flow scheduling)
- Partnerships with federal agencies such as FAA (JPDO/RTTs), DOD (NPAT, ERC) through policy, research and infrastructure

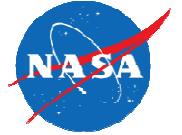
Inspire a new generation workforce

- Scholarships and research grants
- NASA Research Announcements attracting students across 68 universities
- Education outreach across K-12 on aeronautics disciplines

Leverage world-wide capabilities

- Strong partnerships with European and Canadian agencies (France, UK, Germany, Netherlands, Canada) –
 - 20 agreements in force, 11 agreements under development
- New partnerships to leverage emerging capabilities
 - Supersonics research with Japan, rotorcraft research with Korea

Partnership Philosophy



- Help foster a collaborative research environment in which ideas and knowledge are exchanged across all communities.
- Maximize the return on investment to the taxpayer (our main stakeholder).
- In accordance with NASA's Space Act (as amended) and the National Aeronautics R&D Policy, we will provide for the widest practical and appropriate dissemination of our research results (consistent with national security and foreign policy).
- ARMD works under the umbrella of NASA's broad acquisition strategy that utilizes procurement mechanisms such as NASA Research Announcements (NRAs), Request For Proposals (RFPs), SBIR calls, and Space Act Agreements (SAAs).
- ARMD shares technical results and solicits partner insight through annual Technical Interchange meetings (TIMs) and Technical Working Groups (TWGs), journal articles and presentations at technical conferences.

